

WE CLAIM:

1. An apparatus for temporary protection adjacent a site of catheter intervention in a body vessel, the apparatus having a flexible, elongate shaft with a distal region, and a protection element mounted about the shaft distal region and being capable of preventing passage of emboli there through, the protection element comprising:

a self-expanded open configuration having:

a ring portion capable of sealing engagement with a lumen of the body vessel,

a generally conical outer body tapering distally from the ring portion to a distal open apex coupled to the shaft, and

a generally conical inner body extending coaxially within and being shorter than the outer body, the inner body tapering distally from the ring portion to a proximal open apex slidably coupled to the shaft, the inner and outer bodies being connected to each other through the ring portion; and

a closed configuration wherein the outer body and the ring portion are compacted about the shaft, and the inner body is enveloped within the compacted outer body,

wherein axial displacement of the proximal open apex towards the distal open apex temporarily transforms the protection element from the open configuration to the closed configuration.

2. The apparatus of claim 1 wherein the inner body is shaped, when the protection element is in the open configuration, to receive a distal portion of an inflated balloon of an interventional catheter.

3. The apparatus of claim 1 wherein the protection element is a filter.

4. The apparatus of claim 3 wherein at least one of the inner and outer bodies comprises a generally tubular braid.

5. The apparatus of claim 3 wherein at least one of the inner and outer bodies comprises a filter material supported by a flexible structure.

6. The apparatus of claim 5 wherein the flexible structure is a generally tubular braid.

7. The apparatus of claim 5 wherein the flexible structure includes a radial arrangement of wire-like struts.

8. The apparatus of claim 1 wherein the protection element is an occluder.

9. The apparatus of claim 8 wherein at least one of the inner and outer bodies comprises a non-porous material supported by a flexible structure.

10. The apparatus of claim 9 wherein the flexible structure is a generally tubular braid.

11. The apparatus of claim 9 wherein the flexible structure includes a radial arrangement of wire-like struts.

12. The apparatus of claim 1 wherein the proximal open apex is inverted such that it extends proximally within the conical inner body.

13. The apparatus of claim 1 wherein the ring portion comprises a folded lip of material connecting the outer body and the inner body.

14. The apparatus of claim 1 wherein the ring portion is capable of a rolling diaphragm movement during transformation of the protection element between the open and closed configurations.

15. The apparatus of claim 1 wherein the distal open apex is fixedly coupled to the shaft.

16. The apparatus of claim 1 wherein the distal open apex is slidingly coupled to the shaft, which further comprises a stop to prevent distal advancement of the distal open apex there beyond.

17. The apparatus of claim 1 wherein the elongate shaft comprises a guidewire.

18. The apparatus of claim 1 further comprising an elongate tubular actuator slidably disposed along the shaft and engageable with the proximal open apex to effect movement thereof towards the distal open apex.

19. The apparatus of claim 18 wherein the actuator comprises an elongate wire-like proximal shaft and a relatively short tubular distal section.

20. The apparatus of claim 18 wherein the actuator comprises a tubular distal portion having a length and a diameter to fit within the inner body when the protection element is in the closed configuration, the actuator further comprising a tubular proximal portion adjacent the tubular distal portion, the tubular proximal portion having a diameter nearly matching a diameter of the ring portion when the protection element is in the closed configuration.

21. The apparatus of claim 18 wherein the actuator comprises a tubular distal portion being sized to fit within the inner body when the protection element is in the closed configuration, the actuator further comprising a sheath portion surrounding a proximal region of the tubular distal portion to form an annular pocket adapted to enclose at least a proximal portion of the protection element when the protection element is in the closed configuration.

22. The apparatus of claim 21 wherein the sheath portion is flared distally to facilitate engagement with and enclosure of the protection element there within.

23. A temporary protection element for use in a body vessel, the protection element, when in a self-expanded open configuration, comprising:

a ring portion capable of sealing engagement with a lumen of the body vessel;  
a generally conical outer body tapering distally from the ring portion to a distal open apex;  
a generally conical inner body extending coaxially within and being substantially shorter than the outer body, the inner body tapering distally from the ring portion to a proximal open apex, the inner and outer bodies being connected to each other through the ring portion; and

wherein axial displacement of the proximal open apex towards the distal open apex temporarily transforms the protection element from the open configuration to a closed configuration wherein the outer body and the inner body have been radially contracted to form a generally cylindrical tube.

24. An apparatus for temporary protection in a body vessel, the apparatus comprising the protection element according to claim 23 mounted about a distal region of an elongate flexible shaft, wherein the distal and proximal open apexes are coupled to the shaft.